

REMARKS / ARGUMENTS

Initially, it is noted that this Amendment is in the newly required format for responses to office actions, such that each section begins on a separate page and a complete claim listing has been provided.

Status of Claims

Claims 1, 9 and 10 have been amended by the foregoing amendments. Claims 2-6 have been cancelled. New Claims 11-16 have been added to more clearly recite the patentable subject matter which cancelled Claims 2-6 were intended to cover. Independent Claim 1 has been amended to more clearly recite the novel features of the present invention. Claim 10 has been amended to correct its dependency since it originally depended from cancelled Claims 2-6, among others. Thus, amended Claim 10 now depends from any one of remaining Claims 1, 7-9 and 11-16.

Claim Rejections Under 35 U.S.C. 112, second paragraph

On pages 2-3 of the Office Action, the Examiner has rejected Claims 2-6, 9 and 10, under U.S.C. § 112, second paragraph, as being indefinite. More particularly, the Examiner commented that Claim 2 does not appear to further modify the process of independent Claim 1, but rather appears to modify the final product for which the product produced by the process of Claim 1 is an intermediate. The Examiner provided additional comments concerning the organization of the claim recitations and confusion regarding the relationship of claimed elements to one another. It is believed that the foregoing amendments and the following discussion and explanations will address these rejections and inconsistencies.

As discussed in the present specification (page 1, line 19 through page 2, line 5), high molecular weight polymers made from higher alkyl (meth)acrylates, i.e., C₈ to C₃₀ alkyl (meth)acrylate monomers, are useful as additives for increasing the melt strength of polyolefin thermoplastic resins. It is noted that

reducing or eliminating gelled polymer chains in polymeric compositions formed from higher alkyl (meth)acrylate monomers would improve the dispersion of such polymeric compositions in the thermoplastic resin and improve the polymeric composition's ability to increase the melt strength of the thermoplastic resin (see present specification at page 2, lines 22-31). Also discussed (page 2, lines 11-21 of the present application), it is known in the art that emulsion polymerization of such higher alkyl (meth)acrylate monomers to produce polymeric compositions suitable for the aforesaid use is difficult. Thus, the problem is to provide a polymeric composition formed from higher alkyl (meth)acrylate monomers, but which has non-gelled polymer chains and a high molecular weight, notwithstanding the difficulties of conventional emulsion polymerization of such higher alkyl (meth)acrylate monomers (see present specification at page 14, lines 3-14).

It is submitted, as explained in further detail below, that Applicants' present invention provides the aforesaid high molecular weight polymeric composition having non-gelled polymer chains, as well as a process for making same. Moreover, the present specification provides descriptions of various embodiments of the present invention, including where the polymeric composition having non-gelled polymer chains is simply in the form of polymer particles in aqueous dispersion (see present specification, page 8, lines 7-16, page 9, lines 17-22; page 10, lines 12-14; and page 14, lines 15-17).

Alternatively, the polymer particles may, collectively or individually, comprise at least one soft phase and at least one hard phase (see present specification, page 8, lines 24-27 and page 10, lines 10-19). For example, the polymer particles in the aqueous dispersion may comprise at least two populations of particles - a plurality of soft polymer particles which comprise the polymeric composition having non-gelled polymer chains, as well as a plurality of hard polymer particles mixed therewith (see present specification, page 9, lines 4-12 and page 10, lines 4-9).

Furthermore, the polymer particles in the aqueous dispersion may be core-shell type polymer particles, such that the core of each particle comprises

the polymeric composition having non-gelled polymer chains and the shell (or shells) are a hard phase made from at least one ethylenically unsaturated monomer (see, for example, present specification, page 10, lines 14-15 and 20-30; page 12, lines 9-11; and page 14, lines 18-21).

Thus, independent Claim 1 (as originally filed and as amended) is directed to a process for preparing an aqueous dispersion of polymer particles comprising a polymeric composition having non-gelled polymer chains. Contrary to the Examiner's understanding and statements in the Office Action, such an aqueous dispersion of polymer particles, where the polymer particles include only the polymeric compositions of the present invention, may be a final product in and of itself, and not merely an intermediate. However, in certain embodiments, the aqueous emulsion is a multi-phase emulsion and/or particle system which comprises the polymeric composition having non-gelled polymer chains as only one phase or component (see also, present specification, page 14, lines 15-23). The present invention and the claims of the present application are intended to cover these various embodiments, and others, where the polymer particles comprise the polymeric compositions and, optionally, one or more additional phases, soft and hard, either as separate populations of particles mixed together or contained within each individual particle, in the aqueous dispersion. It is hoped that the foregoing discussion provides sufficient explanation to demonstrate the scope of the present invention and clarify the organization and relationship of the subject matter recited in the present claims as presented hereinabove.

With the foregoing in mind, as already mentioned, amended independent Claim 1 clarifies and recites that the present invention is a process for preparing an aqueous emulsion of polymer particles and that the polymer particles comprise a polymeric composition having non-gelled polymer chains. The specific amendments to Claim 1 are discussed in detail hereinafter.

New Claims 11-16 have been added in place of cancelled Claims 2-6 and are believed to further modify the process of the present invention (particularly the polymerization step) as recited in amended independent Claim 1. In

particular, it is submitted that new Claim 11 further clarifies that, in accordance with the present invention, the polymerization step may optionally be performed to result in the production of polymer particles which, collectively and/or individually, comprise at least one soft phase and at least one hard phase, wherein the polymeric composition having non-gelled polymer chains is present in the soft phase, as discussed hereinabove. New Claims 12-16 further clarify and recite different possible embodiments of the aforesaid arrangement, i.e., that the hard phase, where present, may be in the form of a separate plurality of hard particles mixed with the soft phase particles in the aqueous dispersion, or may be found within each of the polymer particles along with the soft phase which comprises the polymeric composition having non-gelled polymer chains, or some combination thereof.

Support and enablement for amended Claim 1 and new Claims 11-16 are found, for example (but not exclusively), in the present specification, as originally filed and as amended above, as follows:

- Amended Claim 1: page 11, line 27, to page 12, line 11; and page 19, lines 21-28.
- New Claim 11: page 8, line 24, to page 9, line 12; page 10, lines 4-9 and 20-30; page 13, lines 4-14; and page 14, lines 15-23.
- New Claim 12: page 8, lines 24-27.
- New Claim 13: page 9, lines 4-12; and page 10, lines 4-9.
- New Claim 14: page 12, lines 3-11.
- New Claim 15: page 14, lines 15-23.
- New Claim 16: page 16, lines 19-24; page 16, line 19 to page 17, line 8; and page 17, lines 9-18.

In the foregoing circumstances, it is believed that the amendments to independent Claim 1 and the introduction of new Claims 11-16 presented above do not introduce any new matter into the present application.

In addition, an error was noted in Claim 1 and has been corrected by the foregoing amendments. More particularly, according to the present specification, on page 7, lines 13-20, the molecular weight of the polymeric composition of the present invention is at least 100,000 g/mol. Moreover, working Example 1, at pages 25-26 of the present specification, demonstrates that molecular weight that is measured is the molecular weight of the polymeric composition having non-gelled polymer chains (i.e., the “molecular weight of the first-stage polymer particle was greater than 100,000 g/mol”). Thus, independent Claim 1 has been amended, by the foregoing amendments, to recite that the polymeric composition, rather than the non-gelled polymer chains, as originally recited, has a molecular weight of at least 100,000 g/mol. In the foregoing circumstances, it is respectfully submitted that the foregoing amendment is supported by the present specification as originally filed and does not introduce any new matter into the present application.

In addition to the issues discussed above, the Examiner rejected Claim 9 based upon his determination that the term “hydrophobic monomer carrier” used therein is not an art-recognized term and is unsupported by the present specification. By the foregoing amendments, Claim 9 has been amended to replace the term “hydrophobic monomer carrier” with the term “monomer transport aid”, which is taken directly from the present specification, at page 13, lines 18-21. The term hydrophobic monomer carrier, used in original Claim 9, described the required composition in terms of its function – i.e., to carry the hydrophobic monomer – which is what the “monomer transport aid” described on page 13 of the present specification does. Thus, it is submitted that substitution use of the term “monomer transport aid” in Claim 9 does not introduce new matter and is supported by the specification as filed.

In the foregoing circumstances, it is hereby respectfully requested that the Examiner enter amended Claims 1, 9 and 10, as well as new Claims 11-16, into the present application for continued examination. Additionally, based upon the foregoing claim amendments and remarks, Applicants and their attorney respectfully submit that the rejections of Claims 2-6, 9 and 10, based upon 35

U.S.C. § 112, second paragraph have been addressed and overcome.

Amendments to the Specification

The foregoing amendments to pages 3-5 of the present specification have been presented to conform the Statement of the Invention section to the claims as amended hereinabove. More specifically, as discussed at length hereinabove, the polymer particles comprise a polymeric composition having non-gelled polymer chains and the polymeric composition (rather than the non-gelled polymer chains) has a weight average molecular weight of at least 100,000 g/mol and the discussions on pages 3-5 now state this. By the foregoing amendments to the specification, certain language on page 7 has been slightly modified to be clear that the molecular weight stated is for the polymeric composition. A typographical error ("surprisingly") on page 3 of the specification has been corrected.

Furthermore, the amended discussion on page 11 of the present specification has been amended to provide a clearer explanation of the types of polymerization suitable for use with the present inventive process. More particularly, although known and understood by persons of ordinary skill in the art, the amended discussion on page 11 now clarifies that emulsion polymerization includes at least two categories – "conventional" or "classical" emulsion polymerization and "miniemulsion" polymerization. Furthermore, as also already known to persons having ordinary skill in the art, the amended discussion at page 11 clarifies that radical chain and step reaction are not additional types of polymerization, but rather, they are two different reaction mechanisms through which any of the foregoing polymerization types (conventional emulsion, miniemulsion, solution and bulk) may proceed.

The language on page 4 of the present specification now conforms to the recitation of amended independent Claim 1, which clarifies that the polymerizing step of the claimed inventive process includes one or more of conventional emulsion polymerization, solution polymerization and bulk polymerization, but excludes miniemulsion polymerization, for reasons discussed hereinafter.

Lastly, it is noted that amendments have been made to Example 5 and the data table relating thereto for the purpose of clarifying the test method used for determination of whether a polymeric composition has gelled or non-gelled polymer chains. These amendments to Example 5 are intended to clarify and provide reproducibility for the results reported in the original data table in the column entitled Results of Test for Presence of Gel (formerly "Notes"). It is noted that the polymeric compositions prepared by the process of the present invention have non-gelled polymer chains because chain branching monomers in an amount of no greater than 0.10 wt % are polymerized with at least one C₈ to C₃₀ alkyl (meth)acrylate monomer by conventional emulsion polymerization as recited in amended independent Claim 1. The test method provided by the foregoing amendments of Example 5 enables persons of ordinary skill in the art to determine whether a particular polymeric composition has such non-gelled polymer chains in accordance with the present invention.

In the foregoing circumstances, it is submitted that the foregoing amendments to the specification do not introduce any new matter to the present invention, but merely clarify issues and definitions which are already discernible and understandable by persons of ordinary skill in the art upon careful and thorough reading of the entire specification and examples of the present application.

Claim Rejections Under 35 U.S.C. §§ 102 and 103

On pages 3-4 of the Office Action, the Examiner rejected Claims 1-6 and 8-10, under U.S.C. § 102(b), as being anticipated by Ishikawa et al. (U.S. Patent No. 6,190,767; corresponding to WO 97/07174). On page 4 of the Office Action, the Examiner rejected Claims 1-6 and 8-10, under U.S.C. § 102(e), as being anticipated by Craun et al. (U.S. Patent No. 6,242,531). On page 5 of the Office Action, the Examiner rejected Claim 7, under 35 U.S.C. § 103(a), as being obvious and unpatentable over Ishikawa et al. or Craun et al. Applicants respectfully traverse these rejections for the reasons which follow.

The present invention, as recited in amended independent Claim 1,

relates generally to a process for preparing an aqueous dispersion of polymeric particles comprising a polymeric composition having non-gelled polymer chains. More particularly, the inventive process involves the step of preparing an aqueous emulsion of hydrophobic monomer droplets and which comprise at least one C_8 to C_{30} alkyl (meth)acrylate monomer, at least one chain branching monomer in an amount not greater than 0.10 weight percent based on the total weight of the C_8 to C_{30} alkyl (meth)acrylate monomer, and at least one emulsifier. The process of the present invention, as recited in amended independent Claim 1, also comprises the step of polymerizing, by at least one technique selected from the group consisting of conventional emulsion polymerization, bulk polymerization and solution polymerization, the C_8 to C_{30} alkyl (meth)acrylate monomer with the chain branching monomer(s) using at least one free radical initiator to form the aqueous dispersion of polymer particles comprising a polymeric composition having non-gelled polymer chains, wherein the polymeric composition has a weight average molecular weight of at least 100,000 g/mol.

It is respectfully submitted that neither of the references cited by the Examiner (i.e., Ishikawa et al. and Craun et al.) anticipate the process of the present invention because neither of these references teach that the polymerization step may be performed by conventional emulsion polymerization, bulk polymerization or solution polymerization, as recited in amended independent Claim 1 of the present application. Rather, both Ishikawa et al. and Craun et al. teach processes based upon miniemulsion polymerization techniques and both references take great care to distinguish the miniemulsion polymerization processes described therein from conventional or "classical" emulsion polymerization (see, generally, Ishikawa et al. at Columns 5-6; and Craun et al. at Columns 2-4). Miniemulsion polymerization, on the other hand, is excluded from the present invention as recited in amended independent Claim 1.

Ishikawa et al. and Craun et al. each explain that in conventional emulsion polymerization, polymerization of the monomers occurs in the aqueous stage of the emulsion and/or in micelles formed by emulsifier (see Ishikawa et al. at Col. 1, lines 48-59; and Craun et al. at Col. 2, lines 55-64). In miniemulsion

polymerization processes, such as those disclosed in these two references, polymerization of the monomers occurs in the monomer droplets because the monomer simply does not migrate into the aqueous phase or into micelles (see Ishikawa et al. at Col. 5, lines 52-54 and at Col. 6, lines 30-31; and Craun et al. at Col. 3, lines 9-10).

Ishikawa et al. further states, at Col. 1, lines 60-66, that when the water solubility of the monomer is excessively low (as is the case of the C₈ to C₃₀ alkyl (meth)acrylate monomer used in the present invention), the monomer "cannot be successfully fed from the monomer oil droplets into the micelle" and that this is "the major reason why a polymer emulsion cannot be prepared from a sparingly water-soluble monomer by the emulsion polymerization". Craun et al. states, at Col. 2, lines 60-64, that "conventional latex [aqueous emulsion] polymerization will not work . . . because the long chain alkyl acrylate and methacrylate esters are not water soluble enough to diffuse from the large monomer droplets into the polymer particles". The very title of Craun et al. – "Acrylic Aqueous Miniemulsion Copolymer Thickeners and Latex Paints Containing Said Thickeners" – is indicative of this reference's singular focus on miniemulsion polymerization.

However, notwithstanding the aforesaid statements in Ishikawa et al. and Craun et al. which predict failure of conventional emulsion polymerization, the process of the present invention as recited in amended independent Claim 1, in fact, successfully employs conventional emulsion polymerization with alkyl (meth)acrylate monomers having up to 30 carbons, some of which are even less water soluble than the C₉ to C₁₃ alkyl (meth)acrylate monomers used in the Ishikawa et al. process and the C₁₁ to C₂₂ alkyl (meth)acrylate monomers used in Craun et al.

Furthermore, neither Ishikawa et al. nor Craun et al. disclose or suggest the suitability of either solution or bulk polymerization techniques for polymerization of such long chain alkyl (meth)acrylate monomers. As is well-known and understood by persons of ordinary skill in the relevant art, solution and bulk polymerization techniques are entirely different from emulsion polymerization techniques (whether conventional or miniemulsion) and neither

Ishikawa et al. or Craun et al mention either. Rather, miniemulsion polymerization is taught in Ishikawa et al. and Craun et al. as the solution for successfully polymerizing long chain alkyl (meth)acrylate monomers in aqueous emulsions.

In the foregoing circumstances, it is respectfully submitted that the disclosures of Ishikawa et al. and Craun et al. do not anticipate the process of the present invention because Ishikawa et al. and Craun et al. both fail to disclose performance of the polymerization step by conventional emulsion polymerization, bulk polymerization or solution polymerization. Ishikawa et al. and Craun et al. both specifically reject the feasibility of using conventional emulsion polymerization at all, and never mention any other technique besides miniemulsion polymerization for successful polymerization of long chain alkyl (meth)acrylate monomers.

In the foregoing circumstances, it is respectfully submitted that the disclosures of Ishikawa et al. and Craun et al. do not anticipate the present invention as recited in amended independent Claim 1. Thus, it is submitted that amended Claim 1 is allowable. Moreover, since Claims 7-16 are all dependent, directly or indirectly, from independent Claim 1, it is submitted that these claims are also allowable.

In view of the foregoing amendments and remarks, re-examination of allowance of all pending claims, including amended independent Claim 1, Claims 7-10 and new Claims 11-16, are respectfully requested.

CONCLUSION

A fee of \$420 is believed to be due in connection with the submission of the Amendment portion of this paper, since it is being submitted within two months after the originally set due date for response to the Office Action. This \$420 fee is addressed by the accompanying Petition for Extension, which authorizes this \$420 to be charged to **Deposit Account No. 18-1850**.

No additional fees are believed to be due in connection with the submission of this Amendment. If, however, any such fees, including petition and extension fees, are due in connection with the submission of this Amendment, the Commissioner is hereby authorized to charge such fees to **Deposit Account No. 18-1850**. In the meantime, please direct all future correspondence relating to the present application to the undersigned attorney.

Respectfully Submitted,



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